the nuclear reactor from when fuel assemblies in the nuclear reactor are replaced and operation of the nuclear reactor is started to when the nuclear reactor is stopped for renewing a portion of the fuel assemblies in the nuclear reactor, and before an end of the one fuel cycle; and

further increasing the flow rate of the coolant supplied to the core based on increasing the number of revolutions of the pump during the another period in a state in which the water rods are completely filled with the coolant and no vapor is present in the water rods at the another period.--

REMARKS

By the above amendment, independent claims 24, 52 and dependent claim 56 have been amended to recite the feature that the fuel assemblies which are renewed are fuel assemblies in the nuclear reactor. Additionally, new claims 61-63 have been presented, corresponding to independent claims 24, 52 and dependent claim 56 reciting the feature that a portion of the fuel assemblies in the nuclear reactor are renewed.

Turning to the rejection of claims 24, 26, 29, 40-43, 50, 52, 53 and 56-59 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed

invention, is traversed, and reconsideration and withdrawal of the rejection are respectfully requested. It is noted that the Examiner acknowledges that "There is support in the original disclosure (including page 15 line 33 to page 16 line 3) (see page 6 of the 3/27/00 response)) for the amendments to claims 24, 52 and 56". Thus, the Examiner acknowledges that the language of the claim is supported by the original disclosure, but apparently contends that the description in the specification does not convey to one of ordinary skill in the art the meaning of one fuel cycle. Applicants submit that the Examiner's position is in error.

Applicants note that in the Amendment filed March 27, 2000, applicants refer to U.S. Patent No. 4,285,769, which describe the exchanging of fuel assemblies at the end of a fuel cycle so that fuel assemblies of exposure for different fuel cycles are present in the core of the reactor. It is not apparent whether the Examiner gave consideration to the disclosure of such patent, and applicants note that this patent (4,283,769) is identified in the specification of this application at page 19, line 29, as well as other portions of the specification. Applicants submit that this patent clearly is representative of the knowledge of those skilled in the art and the acceptance and understanding of the terminology of "fuel cycle" in the art. More particularly, U.S. Patent No. 4,285,769 describes in col. 8, lines 59-65:

> "A reactor of the type described is refueled periodically with a partial batch of fuel which comprises some part of the core. Typically the reactor is operated for twelve to eighteen months between refuelings, depending on the fuel enrichment, refueling batch size and utility grid requirements. These intervals of operation between refuelings are called "fuel cycles" or "cycles of operation". (emphasis added)

As further described in such patent, in col. 1, lines 38-47, "Nuclear reactors are typically refueled periodically... . The reactor is then shut down and a fraction of the fuel assemblies typically about one-quarter of the fuel assemblies, are replaced..." (emphasis added). Furthermore, as described in col. 10, lines 11-17 of such patent, "Typically, an equilibrium core is refueled approximately annularly with replacement of in the order of one-quarter of the fuel assemblies. Thus, a fuel assembly for an equilibrium core resides in the core for about four years with a typical discharge exposure of in the order of 26,000 Mwd/ST (Megawatt days per standard time)." As indicated in col. 13, lines 21 and 22, "At the end of an operating cycle, the reactor is shut down for refueling". Moreover, in accordance with this patent, Figs. 4A-4G illustrate an example core configuration and example of fuel assemblies for use therein in an initial core, as described at col. 10, lines 58-60, whereas as described in col. 13, lines 36-40, "An example configuration of a refueled core in accordance with the invention is

illustrated in Fig. 6A, wherein the subscripts 0-3 of the fuel assembly legends indicate the number of cycles of exposure of the fuel at the time of this refueling." (emphasis added)

Applicants submit that U.S. Patent No. 4,285,769, which is identified in the specification of this application, is representative of the knowledge of those skilled in the art to which the present invention pertains in relation to fuel cycles, and that about one-quarter of all fuel assemblies are renewed after operation of one fuel cycle, with part of the fuel assemblies in the nuclear reactor being renewed once one fuel cycle with the renewed fuel assemblies staying in the nuclear reactor during for fuel cycles. Applicants submit that the claims of this application utilize language as described in the specification of this application and in conformance with the normal usage in the art, irrespective of the Examiner's contentions with regard thereto.

More particularly, as recognized by the Examiner, the claimed features are supported by the description at page 15, line 33 to page 16, line 3 of the specification of this application, which provides that "This operation method applies for one fuel cycle (operation period of a nuclear reactor from when the fuel in the reactor core is replaced and operation of the nuclear reactor is started to when the nuclear reactor is stopped for renewing the fuel, i.e., usually, one year)." As indicated at page 18, line 33 to page

19, line 1 of the specification, "The fuel assembly 1 experiences the fuel cycle operation four times in the reactor core. Therefore, the conditions of Fig. 3A, 3B and 3C are alternatingly repeated four times each." The meaning of this language is that the fuel assembly stays in the nuclear reactor during four fuel cycles (i.e., four years) in an embodiment of the present invention. Additionally, page 26, lines 4 and 5 of the specification refers to "During the period of up to 70% of both the first fuel cycle and the second fuel cycle... (emphasis added), whereas page 26, lines 15-19, provide that "the surplus reactivity in this embodiment is maintained at a minimum level necessary for criticality for a predetermined period of time (Fig. 17(b)) at the end of each of fuel cycles." (emphasis added) It is noted that Fig. 17(b) shows an increase of surplus (excess) reactivity at the beginning of the second fuel cycle and the third fuel cycle, wherein it is apparent that the renewal of a portion of the fuel assemblies in the nuclear reactor is carried out at the end of the first fuel cycle and the second fuel cycle in the present invention, in accordance with the terminology well accepted in the art. As such, applicants submit that all claims should be considered to be in compliance with 35 U.S.C. §112, first paragraph.

The rejection of claims 24 and 50 under 35 U.S.C. §103(a) as being unpatentable over Japan 61256282 in view of Sofer;

the rejection of claims 24 and 50 under 35 U.S.C. §103(a) as being unpatentable over either Japan 0220686 or Japan 0031090 in view of Sofer alone or taken with Japan 61256282; the rejection of claims 26, 26, 29, 40-43, 50, 52-60 under 35 U.S.C. §103(a) as being unpatentable over Matzner in view of Sofer taken with Japan 61256282; the rejection of claims 24, 26, 29, 40-43, 50, 52-60 under 35 U.S.C. §103(a) as being unpatentable over Matzner in view of Sofer and any of Japan 0220686, Japan 0031090 or Japan 61256282 and further in view of applicants own admission of prior art in the specification (e.g. see page 25); the rejection of claims 24, 26, 29, 40-43, 50, 52-60 under 35 U.S.C. §103(a) as being unpatentable over Japan 61256282 in view of Sofer and further in view of Matzner or Kumpf; and the rejection of claims 24, 26, 29, 40-43, 50, 52-60 under 35 U.S.C. §103(a) as being unpatentable over either Japan 0220686 or Japan 0031090 in view of Sofer alone or with Japan 61256282 and further in view of Matzner, of Kumpf; each of such rejections is traversed, and reconsideration and withdrawal of the rejections are respectfully requested.

At the outset, applicants note that independent claims 50 and 52 recite the steps of raising a cooling surface formed between the coolant a vapor in the at least one water rod by increasing the flow rate of the coolant supply to the core based on increasing a number of revolutions of the pump during

one period from a beginning of one fuel cycle, which one fuel cycle is an operation period of the nuclear reactor from when fuel assemblies in the nuclear reactor are replaced and operation of the nuclear reactor is started to when the nuclear reactor is stopped for renewing a portion of the fuel assemblies in the nuclear reactor, and before an end of the one fuel cycle; and further increasing the flow rate of coolant supplied to the core based on increasing the number of revolutions of the pump during another period after the one period to an end of the one fuel cycle in a state in which the at least one water rod is completely filled with coolant; and the steps of raising a coolant surface formed between the coolant and a vapor in the at least one water rod by increasing the flow rate of the coolant supplied to the core based on increasing a number of revolutions of the pump during one period from a beginning of one fuel cycle, which one fuel cycle is an operation period of the nuclear reactor from when fuel assemblies in the nuclear reactor are replaced and operation of the nuclear reactor is started to when the nuclear reactor is stopped for renewing a portion of the fuel assemblies in the nuclear reactor, and before an end of the one fuel cycle; and further increasing the flow rate of the coolant supplied to the core based on increasing the number of revolutions of the pump during another period after the one period to an end of the one fuel cycle in a state in which the

at least one of water rod is completely filled with the coolant and no vapor is present in the another period; respectively. It is noted that similar language is present in new independent claims 61 and 62 and new dependent claim 63. Applicants submit that the features of the independent claims are not disclosed or taught in the cited art for the reasons as set forth in the arguments presented in the Amendment filed March 27, 2000, which are incorporated herein by reference, and for the reasons set forth below.

Applicants note that all of the rejections are based at least upon a combination of Japan 61256282 and Sofer and reference is made to the decision of In re Fine, 5 USPQ 2d 1596 (Fed. Cir. 1988), wherein the court pointed out that the PTO has the burden under §103 to establish a prima facie case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. As further noted by the court, one cannot use hindsight reconstruction to pick and choose

among isolated disclosures in the prior art to deprecate the claimed invention.

In setting forth the rejection based upon 61256282, the Examiner indicates that the paragraph bridging pages 8 and 9 of the English language translation of Japan 61256282 clearly states that the fuel assembly remains in the core for several cycles and that recent boiling water atomic reactors are designed so that the fuel assembly is not moved by shuffling.

While the aforementioned document does disclose that the fuel assembly remains in the core for several cycles and that recent boiling water atomic reactors are designed so that the fuel assembly is not moved by shuffling, such meaning is that the fuel assembly in the core stays at one position in the core during a residence time in the core from when the fuel assembly is loaded into the core to when the fuel assembly is taken out from the nuclear reactor. The residence time is several cycles. The document does not disclose time of renewal of the fuel assembly. However, Fig. 3 of such document is a characteristic diagram showing change of infinite multiplication factor due to fuel cycles. One skilled in the art of the nuclear reactor can understand that the renewal of the fuel assembly in the core is carried out at each end of the first and the second cycles by viewing Fig. 3, because one skilled in the art of the nuclear reactor knows the above-mentioned renewal of the fuel assemblies disclosed

in US 4,285,769. That is, Japan 61256282 teach the renewal of the fuel assembly at each end of the first, the second and third fuel cycles, wherein each of the fuel assembly loaded in the core at each end of the first and the second cycles resides at one position in the core during several fuel cycles.

In the present invention, the rise of the coolant surface formed in the water rod, and the complete filling of the water rod by the coolant are carried out in all fuel assemblies loaded in the nuclear reactor in each fuel cycle.

In Japan 61256282, the rise of the coolant surface formed in the water rod, and the complete filling of the water rod by the coolant are not carried out as recited in the independent claims of this application, irrespective of the whether the flow rate of the coolant supplied to the flow passage near the fuel rods (the flow passage formed between the fuel rods) is increased in the fuel assemblies which resided in the core during two fuel cycles after the deep cut formed in the upper portion of the water rod was meshed with the bar of the water rod penetration part in the fuel assemblies. Thus, the independent claims and dependent claims patentably distinguish over Japan 61256282 in the sense of 35 U.S.C. §103 and should be considered allowable thereover.

As to the patent to Sofer, this patent discloses that flow rate of the coolant being supplied into the fuel assembly

is increased toward the end of a fuel cycle, and that the increase of flow rate of the coolant is carried out in each fuel cycle. However, Sofer only discloses the change of average void ratio in the fuel assembly as described at page 19, lines 14-19 of the specification of this application. Thus, Sofer, like Japan 61256282, fails to disclose or teach the rise of the coolant surface formed in the water rod, and the complete filling of the water rod by the coolant, as recited in the independent claims of this application. Accordingly, all claims patentably distinguish over the combination of Sofer and Japan 61256282 in the sense of 35 U.S.C. §103, and should be considered allowable thereover.

In addition to the deficiencies of the cited art as pointed out above, applicants submit that it is improper to combine the cited art because of inconsistent disclosures of the individual references. That is, the increase of flow rate of the coolant in Sofer is carried out in each fuel cycle, whereas the increase flow rate of the coolant in Japan 61256282 is carried out in the fuel assembly which resides in the core for two fuel cycles. Thus, the Examiner has improperly combined the cited art. See In re Fine, supra.

As to the other cited art utilized in the rejection of the claims, applicants note that in Japan 0220686, the fuel assemblies loaded in the core include each of fuel assembly of the first, second, third and fourth fuel cycles. Each of fuel

assembly of the first, second, third and fourth fuel cycles have different residence times. Each of the fuel assembly having different residence time is loaded into the core by shutting down the nuclear reactor at different times. It is apparent that the renewal of the fuel assembly in the core is carried out at each end of the first and the second cycles by viewing Figs. 4 and 5 of such document.

In Japan 0220686, the rise of the coolant surface formed in the water rod, and the filling of the coolant in the water rod are carried out at the same time to the fuel assemblies which resides in the core during two fuel cycles. The rise of the coolant surface formed in the water rod, and the filling of the coolant in the water rod are carried out by removing the screw 11 (Fig. 3) or cutting the lower end plug (Fig. 6) from the water rod provided in the fuel assemblies which resides in the core during two fuel cycles. The screw 11 is removed from the water after the nuclear reactor is shut down at the end of second fuel cycle of the fuel assembly. However, the fuel assemblies providing the water rod including the screw 11, that is, the fuel assemblies of the first and second fuel cycles shown in Fig. 4 have the water rod in which the coolant surface is formed between the coolant and the vapor. Thus, the core disclosed in Fig. 4 have the fuel assemblies (the fuel assemblies of the first and second fuel cycles) having the water rod in which the coolant surface is

formed between the coolant and the vapor, and the fuel assemblies (the fuel assemblies of the third fuel cycle) having the water rod being completely filled with the coolant.

In contradistinction, in the present invention, as recited in the independent claims, the rise of the coolant surface formed in the water rod, and the complete filling of the water rod by the coolant are carried out in all fuel assemblies loaded in the nuclear reactor in each fuel cycle. Japan 0220686 does not disclose or teach that the rise of the coolant surface formed in the water rod, and the complete filling of the water rod by the coolant are carried out in all fuel assemblies loaded in the nuclear reactor in each fuel cycle.

Further, the teachings of this document is inconsistent with the teachings of Sofer and applicants submit that all claims patentably distinguish over the cited art taken alone or in combination in the sense of 35 U.S.C. §103, and should be considered allowable thereover.

In Japan 0031090, the fuel assemblies loaded in the core include each of fuel assemblies of the first, second, third and fourth fuel cycles. Each of the fuel assemblies of the first, second, third and fourth fuel cycles have different residence time. Each fuel assembly having different residence time is loaded into the core by shutting down the nuclear reactor at different times. It is apparent that the renewal

of the fuel assembly in the core is carried out at each end of the first and the second cycles by viewing Figs. 5 and 6 of the document.

In Japan 0031090, the rise of the coolant surface formed in the water rod, and the filling of the coolant in the water rod are carried out at the same time to the fuel assemblies which reside in the core during two fuel cycles. The rise of the coolant surface formed in the water rod, and the filling of the coolant in the water rod are carried out by removing the screw 14 (Fig. 4) from the water rod provided in the fuel assemblies which resided in the core during two fuel cycles. The screw 14 is removed from the water after the nuclear reactor is shut down at the end of second fuel cycle of the fuel assembly. However, the fuel assemblies providing the water rod including the screw 14, that is, the fuel assemblies of the first and second fuel cycles shown in Fig. 5 have the water rod in which the coolant surface is formed between the coolant and the vapor. Thus, the core disclosed in Fig. 5 have the fuel assemblies (the fuel assemblies of the first and second fuel cycles) having the water rod in which the coolant surface is formed between the coolant and the vapor, and the fuel assemblies (the fuel assemblies of the third fuel cycle) having the water rod being completely filled with the coolant.

In contradistinction, in the present invention, the rise of the coolant surface formed in the water rod, and the

complete filling of the water rod by the coolant are carried out in all fuel assemblies loaded in the nuclear reactor in each fuel cycle. Japan 0031090, like the other cited art, does not disclose or teach that the rise of the coolant surface formed in the water rod, and the complete filling of the coolant in the water rod are carried out in all fuel assemblies loaded in the nuclear reactor in each fuel cycle. Further, the teachings of Japan 0031090 are inconsistent with the teachings of Sofer. Thus, applicants submit that all claims patentably distinguish over Japan 0031090 taken alone or in combination with the other cited art in the sense of 35 U.S.C. §103, and should be considered allowable thereover.

As to the other cited art of Matzner and Kumpf, such patents fail to overcome the aforementioned deficiencies of the above described cited art in relation to the claimed features, such that all claims patentably distinguish over the cited art in the sense of 35 U.S.C. §103, and should be considered allowable thereover.

In view of the above amendments and remarks, applicants submit that all claims present in this application should now be in condition for allowance and issuance of an action of a favorable nature is courteously solicited.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this

paper, including extension of time fees, to Deposit Account No. 01-2135 (501.25507CX5) and please credit any excess fees to such deposit account.

Respectfully submitted,

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